(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
14 June 2001 (14.06.2001)

PCT

(10) International Publication Number
WO 01/43261 A1

(51) International Patent Classification[7]: H02K 15/02, 5/22

(21) International Application Number: PCT/JP00/06829

(22) International Filing Date: 2 October 2000 (02.10.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
11/351296 10 December 1999 (10.12.1999) JP

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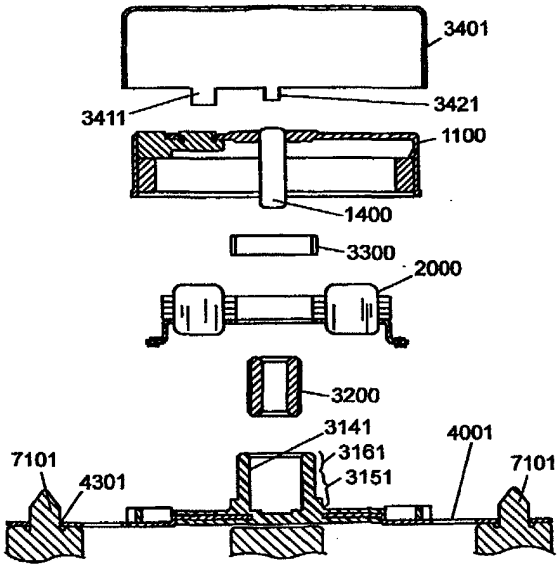
(81) Designated States *(national)*: CN, NO.

(84) Designated States *(regional)*: European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

**Published:**
— *With international search report.*
— *Before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.*

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

(54) Title: MOTOR ASSEMBLED BY USING MOTOR-BASE-HOLDER AND METHOD OF ASSEMBLING THE SAME MOTOR




(57) Abstract: A motor includes a motor-base-holder which comprises a base (3101), a bearing supporter (3151) vertically protruded from the base for supporting a bearing, (3200) a stator supporter concentric with the bearing supporter for being mounted with a stator, (2000) a motor base having terminals (2200) made of a metal plate and insert-molded around the bearing supporter, and a frame (4101) made of the same metal as the terminals and linked to fringe of the motor base. This structure solves difficulties of mini-motors such as difficulties of handling the motor, difficulties of mating those elements each other, and time-consuming bonding

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# DESCRIPTION

## Motor Assembled by Using Motor-Base-Holder and Method of Assembling the Same Motor

### Technical Field

The present invention relates to a construction of a mini-motor and a method of assembling the mini-motor at high productivity. More particularly, the present invention relates to a micro-motor producing vibration sensible to a human body. This micro-motor is employed in a cellular-phone to notify a user of a call with the vibration.

### Background Art

A motor used in information devices comprises the following elements:

a metal base;

a bearing, a printed circuit board, and a stator mounted to the metal base;

a cylindrical rotor magnet mounted on an outer or inner wall of the stator core, thereby facing the magnet to the stator core.

When a motor has a certain size, this structure is easy to assemble; however, downsizing the motor increases difficulties of assembling and lowers the productivity, because assembling machines or operators' finger-tips cannot access to inside or even cannot access close to the motor.

The Japanese Patent Application Non-Examined Publication No. H10-127031 addresses the problem discussed above. Fig. 10 illustrates the motor of this prior art.

In Fig. 10, metal wired-board 14 is buried in base 24 made of synthetic

resin with maintaining the insulation. A first end of board 14 extends over an upper end of base 24 as riser 40, and a second end is exposed as a connector terminal.

This structure allows terminal 42 of winding 18 coiled on stator core 20 to be coupled to riser 40 with ease.

However, downsizing the motor reveals a problem, i.e. elements of the motor are hard to handle by operators. For instance, a motor of 10 mm across gives us a difficulty to handle its components quickly. Further downsizing of the motor requires severer mating allowances between the components. This increases the difficulty of assembling the components into a motor. As such, the productivity is traded off for downsizing the motor. A breakthrough method of this problem has been enthusiastically demanded.

A section bonded with another section or a section undergone resin-welding needs time before it is fixed to. Shortening this waiting time has been also demanded.

## Summary of the Invention

The present invention addresses the problems discussed above, and aims to provide a motor having a structure allowing high productivity as well as a method of assembling the same motor by solving problems such as difficulty of handling, severity of mating, time-consuming of bonding or welding.

A motor-base-holder of the present invention comprises the following elements:

(a) a motor base including;

(a-1) a base;

(a-2) a bearing supporter protruded vertically from the base for supporting a bearing;

(a-3) a stator supporter concentric with the bearing supporter for being mounted with a stator;

(a-4) a terminal made of metal plate and insert-molded around the bearing supporter;

(b) a frame made of the same metal as the terminal and linked with fringe section of the motor base

A motor of the present invention comprises the following elements:

(a) a motor base including;

(a-1) a base;

(a-2) a bearing supporter protruded vertically from the base for supporting a bearing;

(a-3) a stator supporter concentric with the bearing supporter;

(a-4) a terminal made of metal plate and insert-molded around the bearing supporter;

The motor base is formed by cutting off bridges linking between the motor base and the frame around the motor base.

(b) a stator mounted to the stator supporter; and

(c) a rotor supported by the bearing which is supported by the bearing supporter.

Another motor of the present invention comprises the following elements:

(a) a stator having a stator core;

(b) a motor base including:

(b-1) a base;

(b-2) a bearing supporter protruded vertically from the base for supporting a bearing;

(b-3) a stator supporter concentric with the bearing supporter;

(b-4) a stator fixer extending from the stator supporter; and

(c) a rotor supported by the bearing supported by the bearing supporter.

After the stator core is inserted into the stator supporter, a bushing is press-fitted into the stator fixer, thereby fixing the stator.

Still another motor of the present invention comprises the following elements:

(a) a motor base including:

(a-1) a base;

(a-2) a bearing supporter protruded vertically from the base for supporting a bearing;

(a-3) a stator supporter;

(a-4) a terminal made of metal plate and disposed around the bearing supporter;

(a-5) a metal tip extended outside of the motor base;

(b) a stator mounted to the stator supporter;

(c) a rotor supported by the bearing which is supported by the bearing supporter; and

(d) a metal cover of which terminal is fixed to the metal tip, for covering the rotor.

The motor discussed above may be assembled through the following steps:

(a) positioning and supporting the motor base at a given place by the frame;

(b) assembling the stator and the rotor to the motor base; and

(c) detaching the motor base from the frame.

The present invention discussed above can solve the problems particularly in mini-motors such as difficulties in handling the parts of the motor, difficulties in mating the respective components, time-consuming of bonding or welding. As a result, a motor of high productivity and a method of

assembling the motor can be obtained.

## Brief Description of the Drawings

Fig. 1 is a cross section illustrating a structure of a motor in accordance with a first exemplary embodiment of the present invention.

Fig. 2A is a top view of the same motor as shown in Fig. 1.

Fig. 2B is a side view of the same motor as shown in Fig. 1.

Fig. 2C is a bottom view of the same motor as shown in Fig. 1.

Fig. 3A is a plan view of a motor base of the motor shown in Fig. 1.

Fig. 3B is a side view of the motor base of the motor shown in Fig. 1.

Fig. 4 is a plan view of a motor-base-holder.

Fig. 5 is an exploded lateral view of the motor shown in Fig. 1.

Fig. 6 illustrates a motor-base-holder in accordance with a second exemplary embodiment of the present invention.

Fig. 7 illustrates a motor-base-holder in accordance with a third exemplary embodiment of the present invention.

Fig. 8 illustrates a motor-base-holder in accordance with a fourth exemplary embodiment of the present invention.

Fig. 9 is a partial lateral view illustrating how a motor cover is fixed to the motor base in accordance with a fifth exemplary embodiment of the present invention.

Fig. 10 is a cross section illustrating a structure of a conventional motor.

## Detailed Description of the Preferred Embodiments

Exemplary embodiments of the present invention are demonstrated hereinafter with reference to the attached drawings.

(Exemplary Embodiment 1)

Fig. 1 is a cross section illustrating a structure of a motor in accordance with the first exemplary embodiment of the present invention. Fig. 2A is a top view, Fig. 2B is a side view and Fig. 2C is a bottom view of the same motor. Fig. 3A is a plan view of a motor base of the motor shown in Fig. 1. Fig. 3B is a side view of the same motor base. Fig. 4 is a plan view of a motor-base-holder. Fig. 5 is an exploded lateral view of the motor shown in Fig. 1.

In Fig. 1, the motor comprises a stator, a rotor and a cover. The rotor includes rotor frame 1100 and ring-shaped magnet 1200 mounted to an inner wall of rotor frame 1100, and revolves on shaft 1400 mounted at the center thereof. Further, eccentric weight 1300 is mounted to frame 1100, thereby producing vibration when the motor spins.

Stator 2000 is mounted to motor base 3101, and a bearing, i.e. metal 3200, is mounted to the center of base 3101. Stator 2000 includes stator core 2100, wire terminating member 2200, and winding 2300. Terminal 3111 of base 3101 is coupled to winding's terminal 2310. Shaft 1400 is jounaled by metal 3200, and cover 3401 covers the rotor.

An appearance of the motor used in this first embodiment shows, as illustrated in Fig. 2A, circular cover 3401 on polygonal motor-base 3101. As shown in Fig. 2B, cover 3401 has some protrusions 3411 and 3421 extended to base 3101. Some of the protrusions extend to as deep as a lower end of base 3101, and the other are coupled with metal tip 3121 extended from a side face of base 3101. On the bottom face of base 3101, six terminals 3111 are exposed as shown in Fig. 2C. These exposed terminals can be coupled with a base board (not shown) of a device, e.g. a cellular phone, on which the motor is mounted by re-flow soldering. This coupling allows terminals 3111 to carry electric current from the device board to the stator windings, thereby spinning the rotor. Then weight 1300 produces vibrations to make the device vibrate, and this notifies a

device user of a calling.

The motor-base of motor by the present invention is detailed hereinafter.

As shown in Fig. 3B, motor-base 3101 is made of resin molded, and comprises approx. flat base 3131, bearing supporter 3141 protruding vertically from the center of base 3131 for supporting the bearing, and stator supporter 3151 concentric with the bearing supporter and for being mounted with the stator. On base 3131, as shown in Fig. 3A, six terminals 3111 are disposed around bearing supporter 3141. These terminals 3111 are made of metal plate and insert-molded into base 3131. The upper face of terminals 3111 are coupled with the windings' terminals of the stator, and the lower face thereof are coupled with the device board by re-flow soldering.

The motor-base detailed above is a part of a completed motor; however, the present invention preferably handles the motor-base including a metal frame outside thereof when the motor is assembled, to be more specific, motor-base 3101 with metal frame 4101 added to outside of base 3101 forms motor-base-holder 4001 as shown in Fig. 4.

Now, motor-base-holder 4001 is detailed.

Metal frame 4101 shapes in a rectangle with fallen-out section in the center like a picture frame. Motor base 3101 is disposed at the center of holder 4001. Frame 4101 has six bridges 4201 which are arranged in radial at approx. the same intervals around base 3101. As such, frame 4101 surrounds and holds base 3101. Base 3101 is separated off from frame 4101 at perforations 4211 indicated with broken lines. Six round-holes 4301 are punched through frame 4101 for positioning holder 4001.

A process of assembling the motor using holder 4001 is demonstrated with reference to Fig. 5.

First, place holder 4001 on an assembling machine by fitting round-holes

4301 to positioning pins 7101.

Second, mate metal 3200, i.e. the bearing, in bearing supporter 3141 of the motor-base.

Third, insert stator 2000 into stator supporter 3151.

Then press-fit bushing 3300 into stator fixer 3161. In this embodiment, the outer diameter of stator supporter 3151 is the same as that of stator fixer 3161. Bushing 3300 and stator fixer 3161 are manufactured to be tightly mated each other. Stator 2000 can be thus fixed to stator supporter just by press-fitting bushing 3300 into stator fixer 3161.

After that, weld the windings' terminals of stator to the terminal of motor-base. A resistance-welding-machine may be used in this case.

On the other hand, the rotor has been assembled as shown in Fig. 5, and is supplied to the assembled body of motor-base-holder 4001 with stator 2000. A motor assembling machine chucks rotor frame 1100, and inserts shaft 1400 by centering metal 3200.

Then cap the rotor with cup-shaped cover 3401. At this time, protrusions 3411 and 3421 extended from the end of cover 3401 are positioned with corresponding places on the motor-base.

Protrusions 3421 is fixed to metal tip 3121 protruded from the motor-base by welding as shown in Fig. 2B. A laser-welding-machine may be used in this case.

Finally, base 3101 is cut off from frame 4101 at perforations 4211 shown in Fig. 4.

The motor thus assembled is shipped to the market after inspection and packaging. Meanwhile, a performance inspection is carried out as follows: the electrical conductance between terminals and bridges of the motor base is cut off, or the bridge is kept as a common grounding terminal, then the motor being

kept on the metal frame can be inspected.

The motor in accordance with the first embodiment uses motor-base-holder 4001 linked with metal frame 4101 made of the same material as terminal 3111, and holder 4001 is disposed outside of motor base 3101. Frame 4101 made by punching a piece of metal plate together with terminals 3111 positions base 3101 with respect to the assembling machine. The insert-mold into base 3101 is carried out with respect to round holes 4301 of frame 4101, base 3101 can be thus positioned much more precisely than a conventional method which sets positioning reference on a resin-made motor-base. The method of the present invention thus can deal with a micro motor which requires a precise mating allowance, and can realize to assemble the micro motor at high productivity.

In the motor of this first embodiment, base 3101 is positioned together with base-holder 4001 and supported by bridges 4201. Bearing supporter 3141 protrudes vertically from the base center, and metal 3200 is mounted to bearing supporter 3141, therefore, metal 3200 also protrudes from base 3101 with a certain distance. Bridges 4201 supporting base 3101 is elastically deformed by lateral force. When shaft 1400 is inserted into metal 3200, this structure produces centering action between them. This centering action contributes to high productivity of assembling the micro motor.

The motor in accordance with this first embodiment is a micro-flat-motor of 10 ㎜ across. The shaft of the motor is 0.8 ㎜ across and a clearance between the shaft and the metal (bearing) is max. several μm. This precision is not only required by these elements but also by other elements. Automatic machines assemble those elements into a micro-motor at a high speed. Such an ultra-micro motor owes the high-speed assembly to the assembling method of the present invention, which allows quick handling of elements, highly precise

positioning, and automatic centering action.

In the first embodiment, trim 4401 is disposed between bridge 4201 and picture-frame type frame 4101. This trim 4401 functions as follows: Terminals 3111 made of metal plate are disposed on the bottom face of the motor so that the device board can be soldered with the motor by re-flow soldering. However, the metal plate should be insulated and yet held, thus the metal plate must be insert-molded in the resin of base 3101. Therefore, the metal plate is inevitably shaped in a step-like form. In this case, trim 4401 allows less stress to remain in the metal plate, thus sections around the terminals and the metal frame are free from being abnormally deformed.

In the first embodiment, a plurality of perforations 4211 are disposed around base 3101, and frame 4101 is separated from base 3101 at perforations 4211 which are, more particularly, arranged at the same intervals around base 3101. This structure prevents base 3101 from being supported unbalancedly, therefore, when a vertical external forces is applied, it directs the displacement in vertical direction. This does not lower the positioning precision for assembly. When a radial external force is applied to metal 3200, it causes uniform elastic deformation in all directions. This does not adversely affect the centering action. As a result, an ultra-micro-motor can be assembled with high productivity.

A plurality of perforations are arranged on both sides of a center line of base 3101 so that the effect discussed above can be obtained with ease. As will be discussed in a third embodiment, perforations cannot be arranged uniformly in all directions for some reason; and yet, the perforations are preferably arranged around the motor-base to be symmetric with respect to a point.

As Fig. 1 and Fig. 5 illustrate, stator core 2100 is inserted into stator supporter 3151, then bushing 3300 is press-fitted into stator fixer 3161, thereby

fixing stator 2000 to stator supporter 3151. Since only press-fitting of bushing 3300 can fix stator 2000, the waiting-time after bonding or welding the stator can be saved. As a result, total assembly time can be shortened.

Protrusions 3421 extended from fringe of cover 3401 are fixed to metal tips 3121 extended from base 3101. This structure, i.e. connection between metals, yields a strong bonding force per unit area. Thus the bonding can be completed with a small area, and this is preferable for an ultra-micro-motor. The structure discussed above also allows the fringe of cover 3401 to be electrically coupled with metal tips 3121. Accordingly, while metal tip 3121 is electrically coupled to terminal 3111, metal tip 3121 is grounded to the device, thereby shielding electromagnetic noises produced by the motor.

In the first embodiment, protrusions 3421 are welded to tips 3121, so that coagulating time of the welding is shorter than that for resin. As a result, the total assembly time of the motor can be shortened. A protruded amount to outside the motor is less than that by engaging-deformation-fixing method which is discussed in a fifth embodiment. Thus the first embodiment is more advantageously for downsizing the motor over the fifth embodiment.

(Exemplary embodiment 2)

Fig. 6 illustrates a motor-base-holder in accordance with the second exemplary embodiment of the present invention.

In Fig. 6, rectangular metal frame 4102 of motor-base-holder 4002 is formed by linking the metal frames shown in Fig. 4 and used in the first embodiment. Metal frame 4102 includes four pieces of motor-bases 3101. Six bridges 4202 are provided to each base 3101 and they are arranged in radial at approx. the same intervals. Round holes 4302 for positioning are provided in total 18 on frame 4102.

In the second embodiment, a plurality of motor-bases are linked to form a rectangle. Since this holder holds a plurality of motor-bases, better handling can be expected than holding a single base, and ultra-micro-motors can be handled with much ease. A positioning time at each step as well as an assembling time decreases at greater numbers of motor-base held by the holder. In this second embodiment, a rectangle containing several motor-bases or maximum not more than 20 motor-bases is handled, i.e. as far as the rectangle keeps a plate and not shapes in a hoop, so that bending stress is not applied to this size of rectangle in storage. As a result, the motor-bases are not deformed by creep. This is different from a third embodiment discussed later because the third embodiment addresses a belt-like holder.

(Exemplary Embodiment 3)

Fig. 7 illustrates a motor-base-holder in accordance with the third exemplary embodiment of the present invention.

Metal frame 4103 of motor-base-holder 4003 extends long and forms a belt. Frame 4103 contains numbers of motor-bases 3101. Four bridges 4203 (two bridges per side) are provided to each base 3101, this is different from that of the second embodiment. Bases 3101 are linked to frame 4103 by bridges 4203 at both the sides of the frame in width direction of the belt. Round holes 4303 for positioning are sequentially provided on frame 4103.

In the third embodiment, as discussed above, fringes of plurality of motor-bases are linked by the metal frame, thereby forming a belt. This structure allows the motor-base to be transferred with the metal frame in sequence, so that the motors can be continuously assembled. This structure thus can simplify a transferring mechanism, and allows assembly equipment to be compact and inexpensive. As a result, an inexpensive motor can be

manufactured at high productivity.

Adjacent motor-bases in the holder of this third embodiment are separated in the longitudinal direction of the belt. When the belt-like holder is wound on a reel, the motor-base which is insert molded is free from bending stress. Thus creep is prevented to occur on the resin in storage of the motor-bases, resin-mold products are not degraded their precision in shape.

A number of bridges is preferably not more than three on one side. If more than two bridges are provided on one side, bending stress tends to occur in the motor-base when the metal frame warps.

(Exemplary Embodiment 4)

Fig. 8 illustrates a motor-base-holder in accordance with the fourth exemplary embodiment of the present invention.

Metal frames 4104 of motor-base-holders 4004 are linked with each other to form a belt. However, the metal frame used in the first embodiment is not just linked in the longitudinal direction, but the metal frame is linked with the sections forming both sides of the belt (these sections may be part of metal frame 4104). Six bridges 4204 are provided to each base 3101 as same as the first embodiment and support the base evenly.

The motor-bases held by this holder are separated in the longitudinal direction. The resin-made motor bases are thus prevented from creep in storage, and resin-mold products are not degraded precision in shape. Further, each motor base is supported its surrounding evenly, so that the uniform centering action in all directions is obtainable.

(Exemplary Embodiment 5)

Fig. 9 is a partial lateral view illustrating how a motor cover is fixed to

the motor base in accordance with the fifth exemplary embodiment of the present invention.

In Fig. 9, protrusions 3422 extended from end of cover 3402 extends their tips outwardly in radial direction. Metal tips 3122 extended from a motor base are folded so that the tips can clip protrusions 3422.

In this fifth embodiment, the end of cover and the metal tips of motor base are engaged and deformed to fix each other. Metal is easy to deform flexibly and it maintains the strength after deformation. Therefore, the metal can be bonded with a small area, and this is preferably to an ultra-micro-motor. The fixation by this engaging-deformation needs not the time before solidification, while heat-resin-bonding requires some time for solidification. As a result, assembly time of the motor can be shortened.

Several exemplary embodiments of the present invention have been demonstrated; however, the present invention is not limited to these embodiments but various applications are available within the scope of the invention. The present invention is good for ultra-micro-motors as discussed in the embodiments; however, it is also applicable to various kinds of motors. Round holes for positioning are disposed on the metal frame on both sides; however, the round holes may be disposed on one side.

As discussed above, the present invention solves the difficulty of handling motors, difficulty of mating elements of the motors, time-consuming bonding, and provides a motor allowing high productivity as well as a method of assembling the same motor.

## Industrial Applicability

The present invention provides a structure best-suited to a mini motor

and a method of assembling the same motor at high productivity. A motor of the present invention comprises: a motor-base-holder including (a) a base, (b) a bearing supporter vertically protruding from the base for supporting a bearing, (c) a stator supporter concentric with the bearing supporter for being mounted with a stator, (d) a motor base made of metal plate and having a terminal insert molded around the bearing supporter, and (e) a frame made of the same metal as the terminal and linked to fringe of the motor base. The present invention also provides a method of assembling the same motor. The present invention is best-suited to an ultra-micro-motor for producing vibration to notify a user of a calling. Such a motor is employed in, e.g. cellular phone.

# CLAIMS

1. A motor-base-holder comprising:

(a) a motor base including:

(a-1) a base;

(a-2) a bearing supporter protruded vertically from said base for supporting a bearing;

(a-3) a stator supporter concentric with said bearing supporter for being mounted with a stator;

(a-4) a terminal made of metal plate and insert-molded around said bearing supporter;

(b) a frame made of the same metal as the terminal and linked with fringe of said motor base

2. The motor-base-holder as defined in Claim 1, wherein a plurality of said motor bases are linked to each other.

3. The motor-base-holder as defined in Claim 1, wherein a plurality of said motor bases are linked to each other and form a belt-like shape.

4. The motor-base-holder as defined in Claim 3, wherein a plurality of said motor bases are linked to said frame in width direction of the belt-like shape, and adjacent said motor bases are separated in longitudinal direction.

5. A motor comprising:

(a) a motor base including;

(a-1) a base;

(a-2) a bearing supporter protruded vertically from said base for supporting a bearing;

(a-3) a stator supporter concentric with said bearing supporter;

(a-4) a terminal made of metal plate and insert-molded around said bearing supporter;

wherein said motor base is formed by cutting off bridges linking between said motor base and a frame around said motor base.

(b) a stator mounted to the stator supporter; and

(c) a rotor supported by the bearing which is supported by said bearing supporter.

6. A motor comprising:

(a) a stator having a stator core;

(b) a motor base including:

(b-1) a base;

(b-2) a bearing supporter protruded vertically from said base for supporting a bearing;

(b-3) a stator supporter concentric with said bearing supporter;

(b-4) a stator fixer extended from said stator supporter; and

(c) a rotor supported by said bearing supported by said bearing supporter,

wherein after the stator core is inserted into said stator supporter, a bushing is press-fitted into said stator fixer, thereby fixing said stator.

7. A motor comprising:

(a) a motor base including:

(a-1) a base;

(a-2) a bearing supporter protruded vertically from said base for supporting a bearing;

(a-3) a stator supporter;

(a-4) a terminal made of metal plate and disposed around said bearing supporter;

(a-5) a metal tip extended outside of said motor base;

(b) a stator mounted to said stator supporter;

(c) a rotor supported by the bearing which is supported by said bearing supporter; and

(d) a metal cover, of which end is fixed to said metal tip, for covering said rotor.

8. The motor as defined in Claim 7, wherein the end of said metal cover is fixed to said metal tip by welding.

9. The motor as defined in Claim 7, wherein the end of said metal cover is fixed to said metal tip by engaging and deforming thereof.

10. A method of assembling a motor using a motor-base-holder, wherein the motor-base-holder comprises:

(a) a base;

(b) a bearing supporter protruded vertically from said base for supporting a bearing;

(c) a stator supporter concentric with said bearing supporter for being mounted with a stator; and

(d) a motor base having a terminal made of a metal plate and insert-molded around the bearing supporter; and

(e) a frame made of the same metal as the terminal and linked with fringe of said motor base,

wherein said method comprises the steps of:

positioning and supporting the motor base at a given place by the frame;

assembling the stator and a rotor of said motor to the motor base; and

detaching the motor base from the frame.

11. The method of assembling a motor as defined in Claim 10, wherein said motor-base-holder uses a plurality of motor bases linked to each other.

12. The method of assembling a motor as defined in Claim 10, wherein said motor-base-holder uses a plurality of motor bases linked to each other to form a belt-like shape.

13. The motor as defined in Claim 5, wherein the bridges are dispersively disposed around said motor base as well as between the frame and said motor base.

FIG. 1

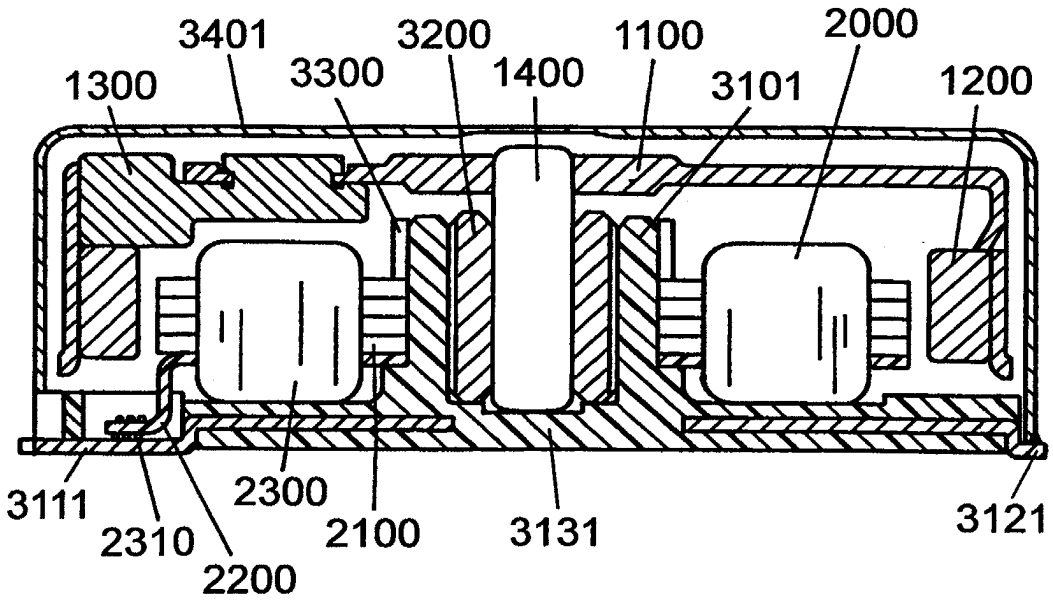

3401
3200
1100
2000
1300
3300
1400
3101
1200
3111
2310
2200
2300
2100
3131
3121

FIG. 2A

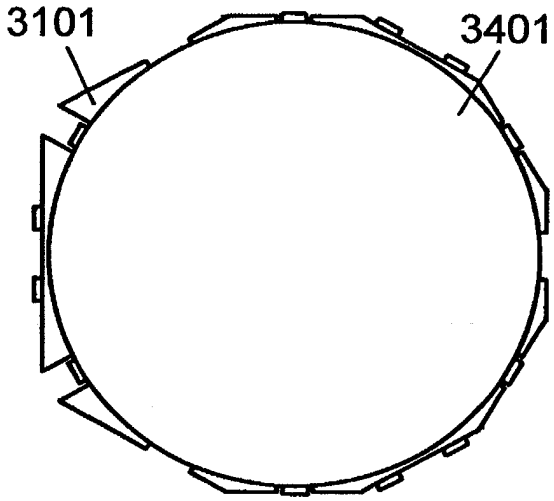



FIG. 2B

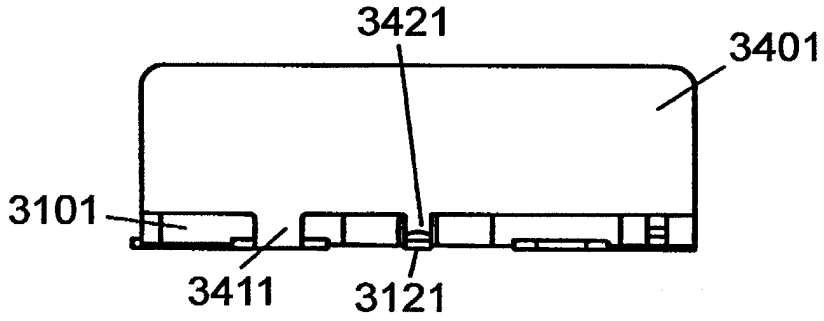



FIG. 2C

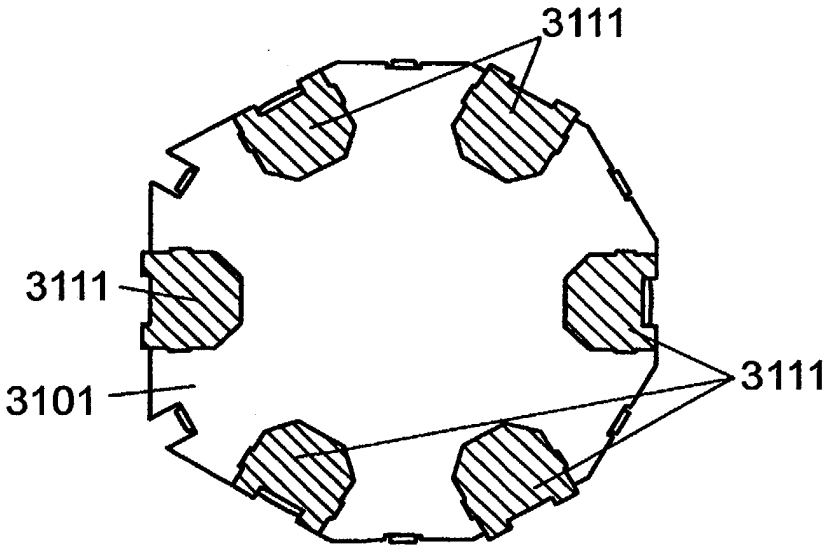


FIG. 3A

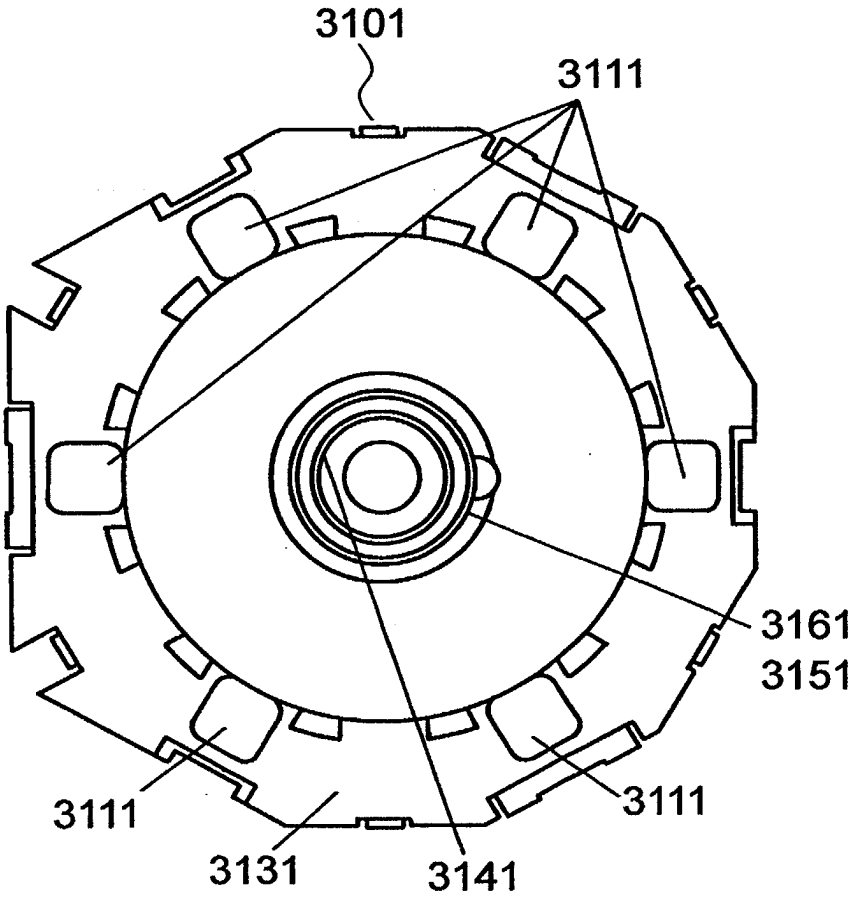

3101
3111
3161
3151
3111
3111
3131
3141

FIG. 3B

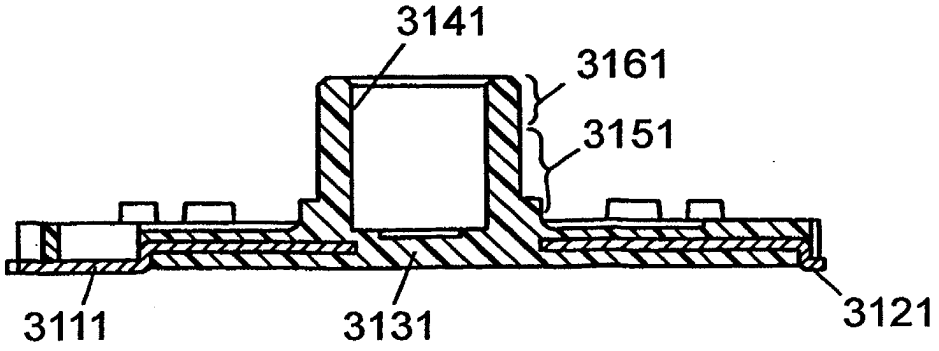

3141
3161
3151
3111
3131
3121

FIG. 4

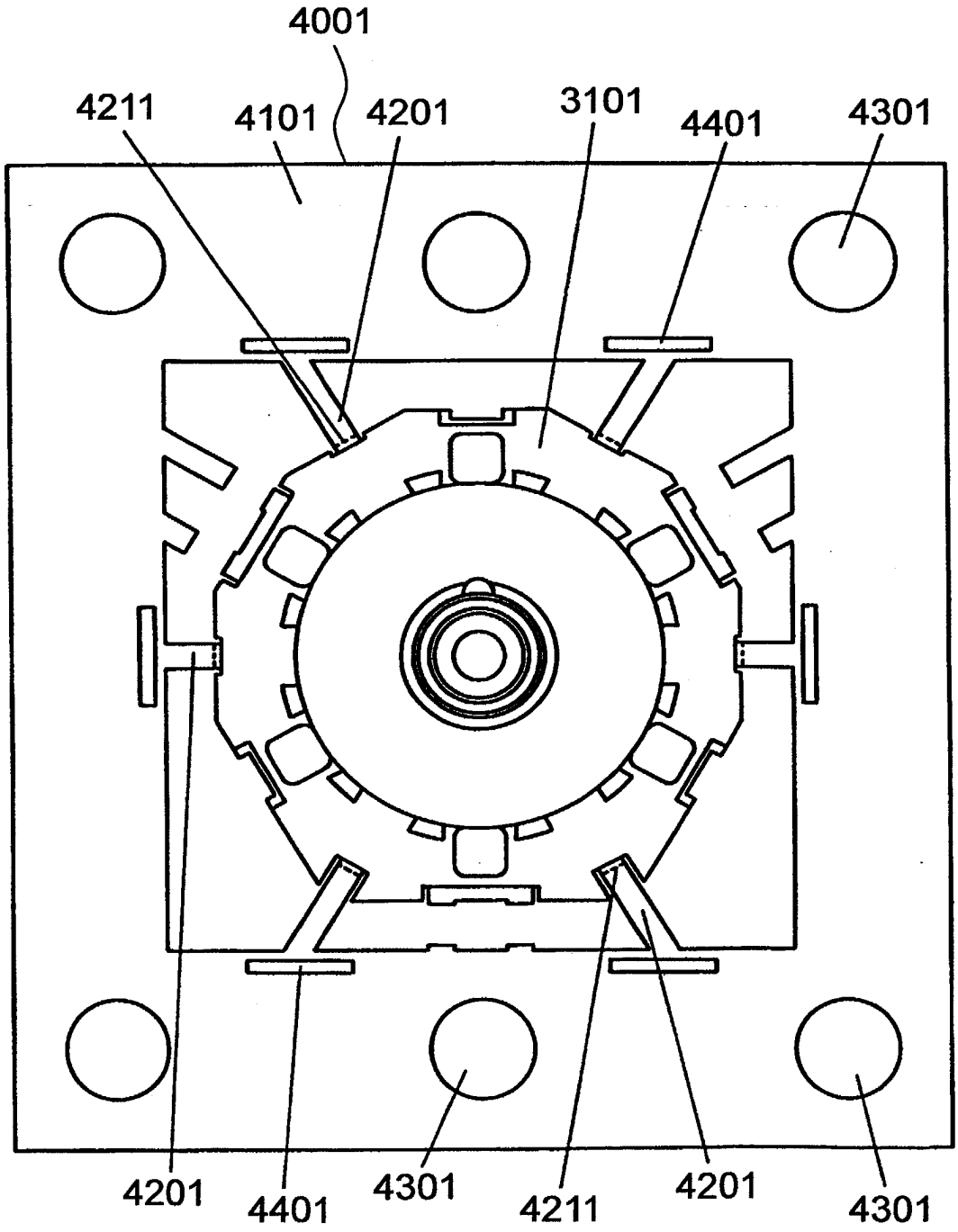

4001
4211
4101
4201
3101
4401
4301
4201
4401
4301
4211
4201
4301

FIG. 5

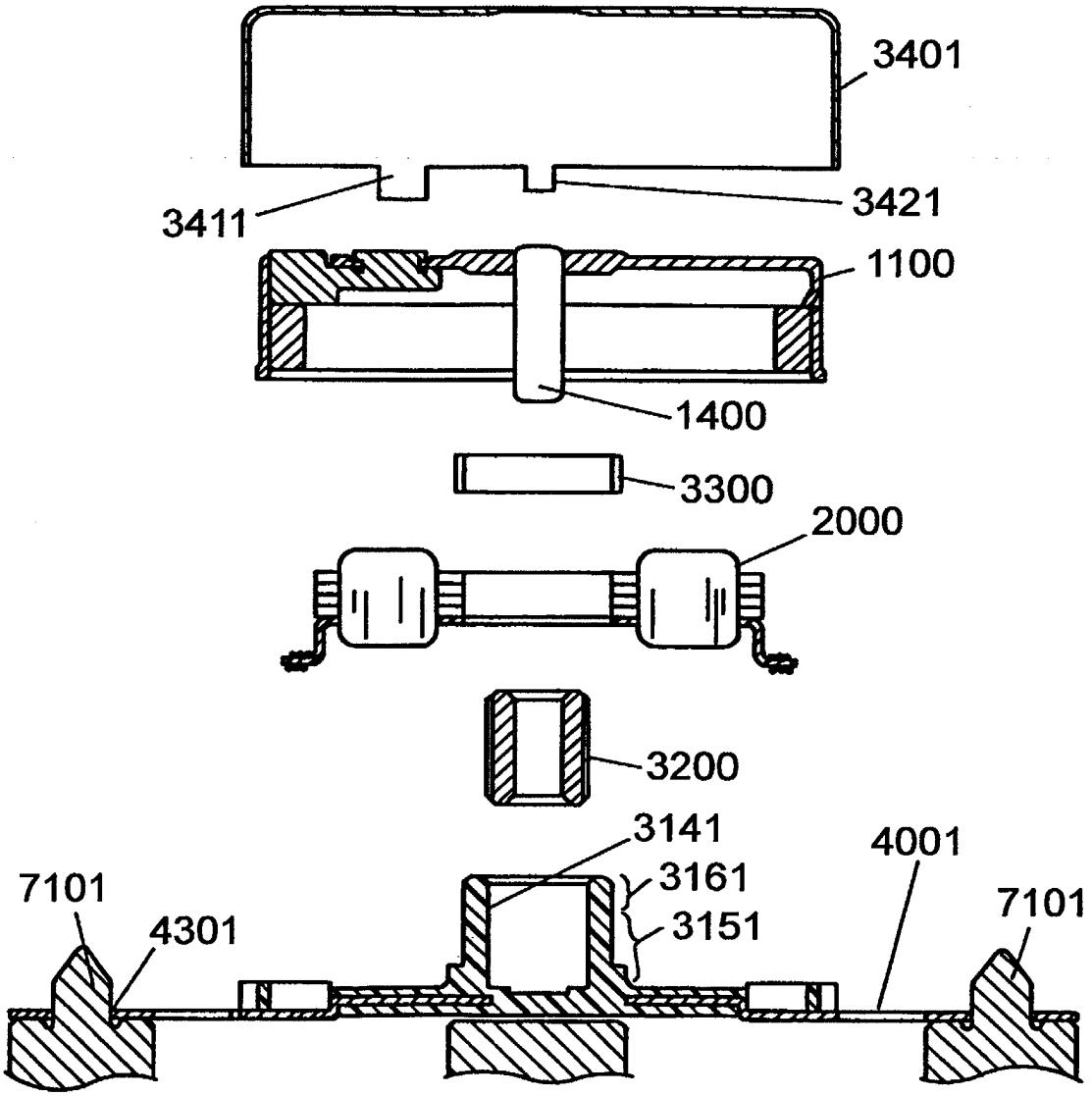

3401
3411
3421
1100
1400
3300
2000
3200
3141
3161
3151
4001
7101
4301
7101

FIG. 6

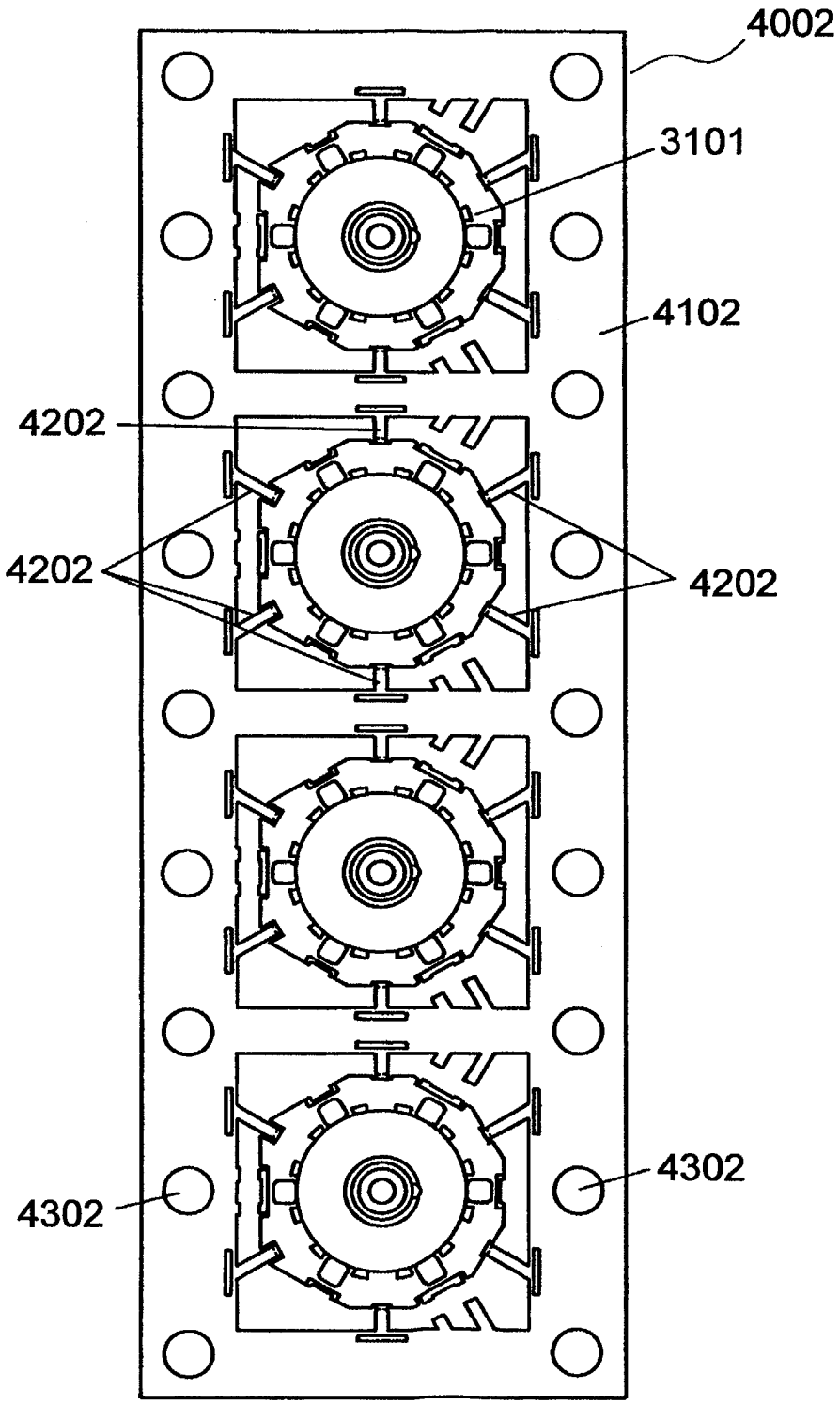


FIG. 7

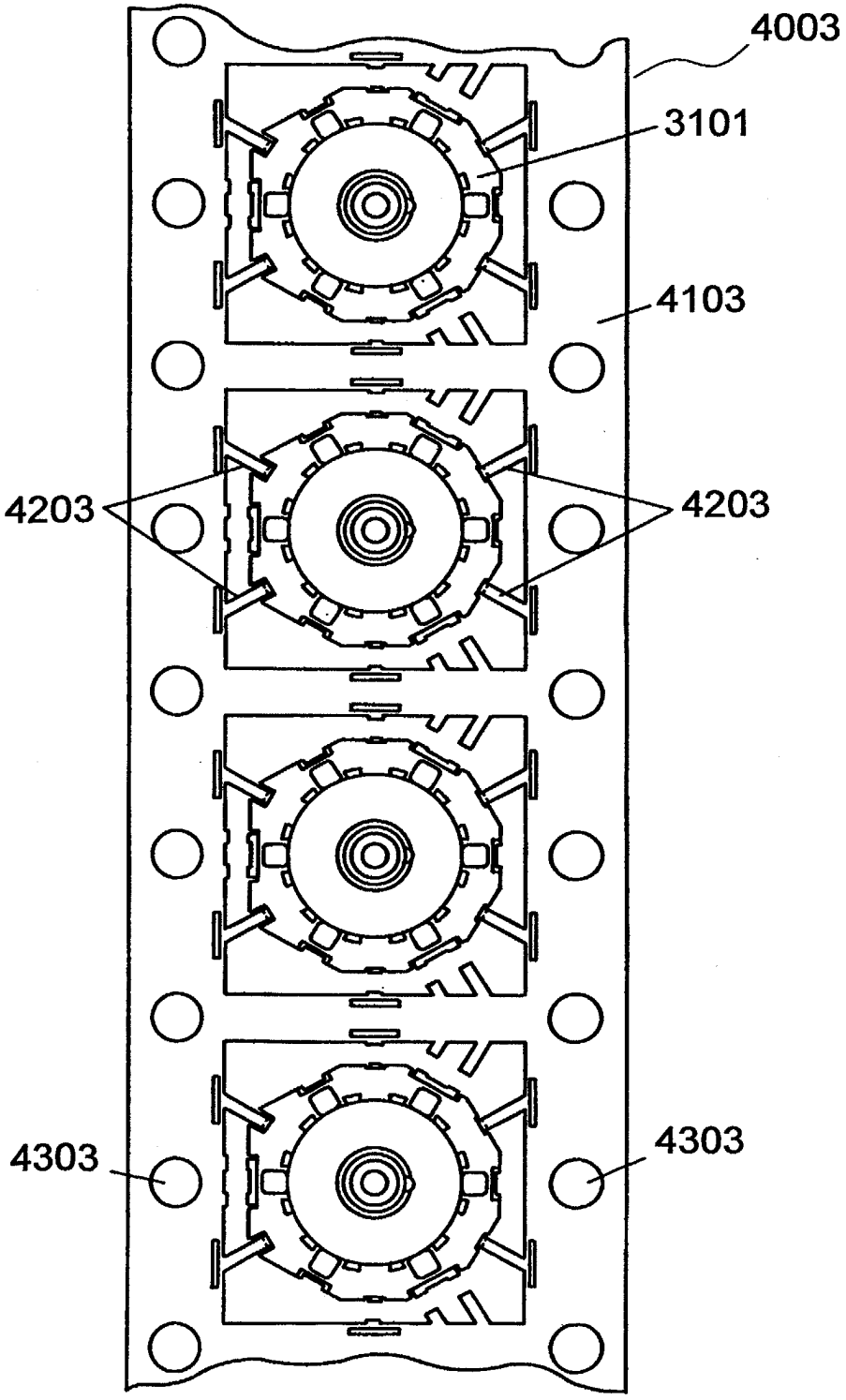


FIG. 8

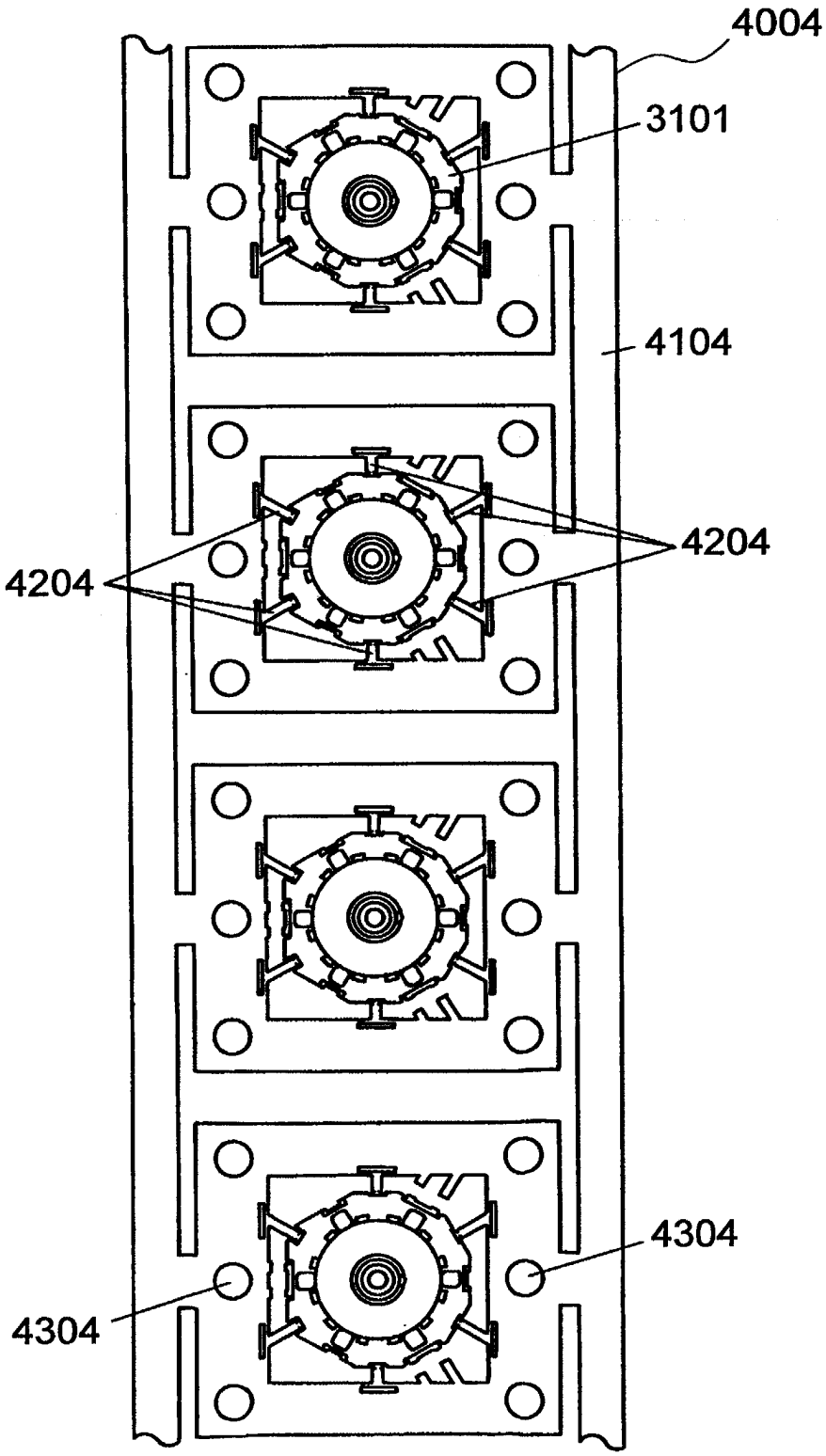


FIG. 9

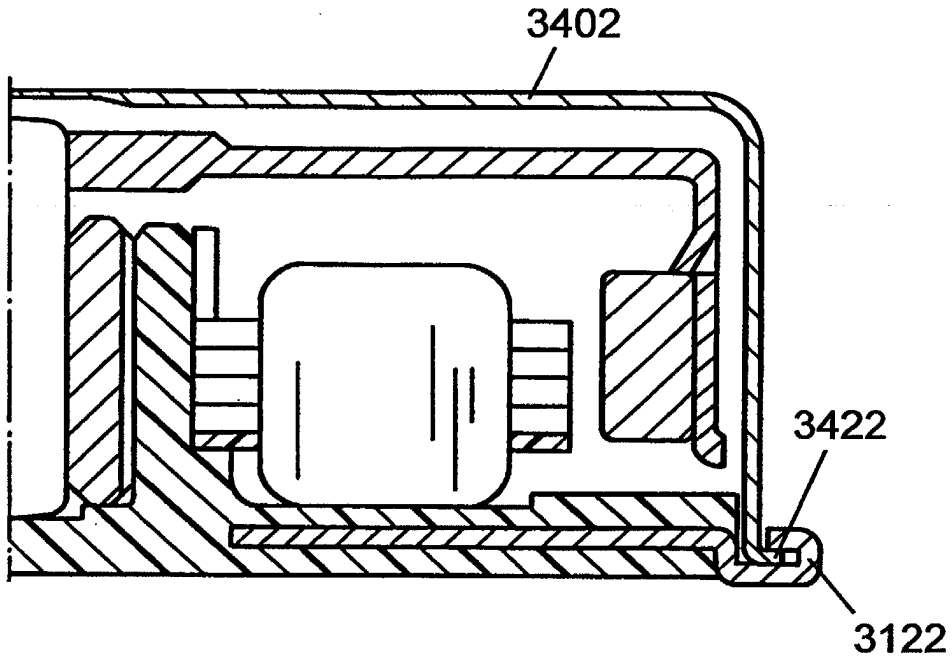
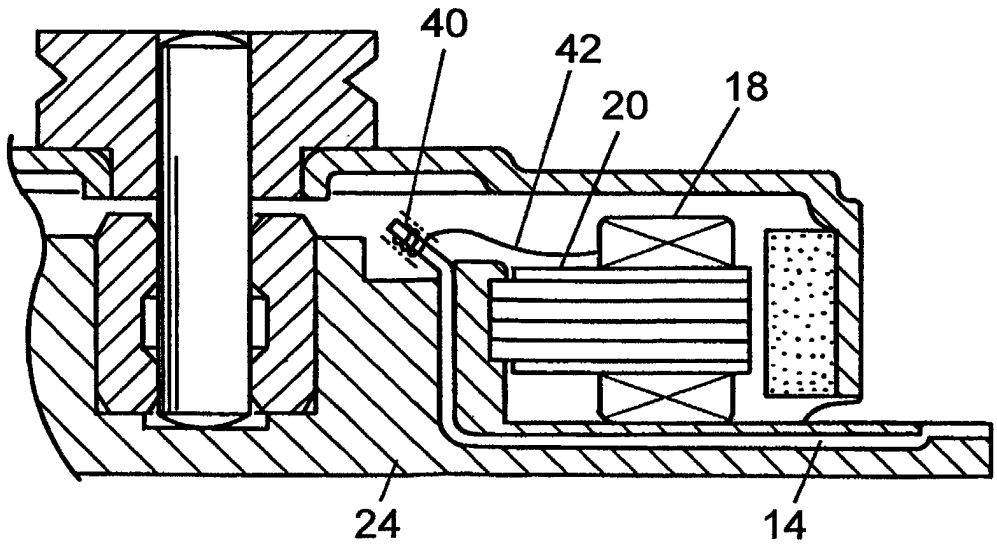



FIG. 10



Reference numerals in the drawings

2000 Stator

3101 Motor base

3111 Terminal

3121 Metal tip

3131 Base

3141 Bearing supporter

3151 Stator supporter

3161 Stator fixer

3300 Bushing

3401, 3402 Cover

3411, 3421, 3422 Protrusion

4001, 4002, 4003, 4004 Motor-base-holder

4101, 4102, 4103, 4104 Metal frame

4201, 4202, 4203, 4204 Bridge

4211 Perforation

4301, 4302, 4303 Round hole

4401 Trim

7101 Positioning pin

# INTERNATIONAL SEARCH REPORT

Inter. nal Application No
PCT/JP 00/06829

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H02K15/02 H02K5/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H02K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | PATENT ABSTRACTS OF JAPAN<br>vol. 1999, no. 02,<br>26 February 1999 (1999-02-26)<br>-& JP 10 295068 A (SANKYO SEIKI MFG CO LTD), 4 November 1998 (1998-11-04) | 1,5,10, 13 |
| Y | abstract | 2,3,7-9, 11,12 |
| Y | US 4 673 837 A (GINGERICH DAVID J ET AL)<br>16 June 1987 (1987-06-16)<br>column 2, line 45 - line 50<br>column 3, line 5 - line 37; figures 1-3 | 2,3,11, 12 |

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 28 March 2001 | 03.04.01 |

| Name and mailing address of the ISA | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,<br>Fax: (+31-70) 340-3016 | Roy, C |

# INTERNATIONAL SEARCH REPORT

Interi ıal Application No
PCT/JP 00/06829

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | PATENT ABSTRACTS OF JAPAN<br>vol. 1997, no. 07,<br>31 July 1997 (1997-07-31)<br>-& JP 09 070162 A (MATSUSHITA ELECTRIC IND CO LTD), 11 March 1997 (1997-03-11)<br>abstract | 1,5,13 |
| X | PATENT ABSTRACTS OF JAPAN<br>vol. 1998, no. 09,<br>31 July 1998 (1998-07-31)<br>& JP 10 108433 A (TOSHIBA LIGHTING &TECHNOL CORP),<br>24 April 1998 (1998-04-24)<br>abstract | 6 |
| Y | US 4 853 568 A (FUJIWARA HITOSHI)<br>1 August 1989 (1989-08-01)<br>column 1, line 18 - line 27; claim 1;<br>figures 1,2 | 7-9 |
| A | PATENT ABSTRACTS OF JAPAN<br>vol. 018, no. 263 (E-1550),<br>19 May 1994 (1994-05-19)<br>& JP 06 038432 A (MATSUSHITA ELECTRIC IND CO LTD), 10 February 1994 (1994-02-10)<br>abstract | 7-9 |

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP 00/06829

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

**Remark on Protest**

☐ The additional search fees were accompanied by the applicant's protest.

☒ No protest accompanied the payment of additional search fees.

# INTERNATIONAL SEARCH REPORT

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

International Application No. PCT/JP 00/06829

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-5,10-13

   motor, method for assembling a motor using a motor base holder and motor base holder comprising several motor bases

2. Claim : 6

   motor with a secure attachment of the stator to the stator supporter

3. Claims: 7-9

   motor with a grounded cover

# INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter nal Application No
PCT/JP 00/06829

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| JP 10295068 A | 04-11-1998 | NONE | |
| US 4673837 A | 16-06-1987 | US 4783906 A | 15-11-1988 |
| | | US 4895536 A | 23-01-1990 |
| JP 09070162 A | 11-03-1997 | NONE | |
| JP 10108433 A | 24-04-1998 | NONE | |
| US 4853568 A | 01-08-1989 | CN 88100872 A,B | 14-09-1988 |
| | | DE 3803267 A | 25-08-1988 |
| | | GB 2201301 A,B | 24-08-1988 |
| | | HK 83194 A | 26-08-1994 |
| JP 06038432 A | 10-02-1994 | NONE | |